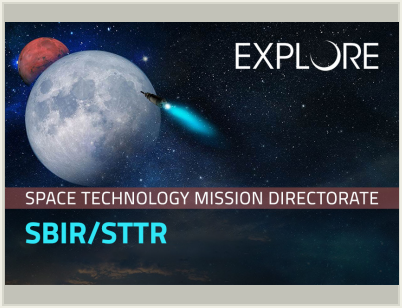
A Miniaturized Sensor for Microbial Monitoring of Spacecraft Water Environment, Phase II

Completed Technology Project (2011 - 2014)

Project Introduction

Accurate real-time microbial monitoring of water environment is of paramount importance to crew health as well as to ensure proper functioning and control of the life support system during space exploration. The existing methods are time-consuming and labor-intensive, and the devices used are bulky, consumable-hungry, and ill-suited for spacecraft deployment. We propose to develop and demonstrate a novel, fully automated, milli-/micro-fluidics-based sensor cartridge for sample preparation and detection of microbes in water. The final product will be compact, accurate, fully integrated and automated, power-effective, and fieldable in space environments. In Phase 1, key technology elements have been successfully demonstrated. Major components of the sensor cartridge were designed using a computational virtual-prototyping approach followed by state-of-the-art microfabrication and engineering. Experiments with microbial samples commonly found in space water environment were undertaken to demonstrate component functionality and to establish proof-of-concept of the proposed technology. In Phase 2, efforts will focus along two lines. First, component design optimization will be carried out with fabrication enhancements and extended testing and characterization for technology validation. Second, an integrated microfluidic cartridge and instrumentation capable of automated operation (sample processing and detection) will be developed. The prototype instrument will be demonstrated in both terrestrial and hypogravity environments (in collaboration with NASA researchers/facilities). A multi-disciplinary team with experience in all aspects of the proposed effort including fluidic system design, fabrication and experimentation, systems engineering, microbiology and spaceflight has been assembled to ensure successful completion of project milestones.



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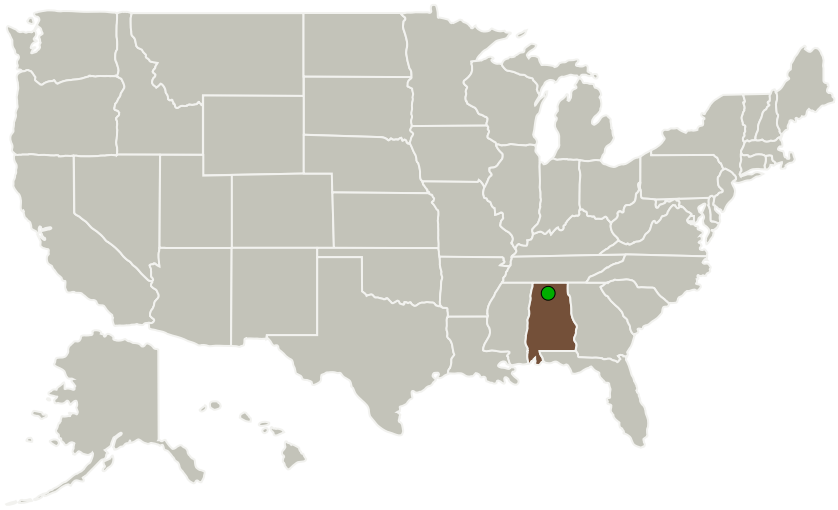
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Transitions

June 2011: Project Start

February 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138622)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CFD Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Yi Wang

Co-Investigator:

Yi Wang

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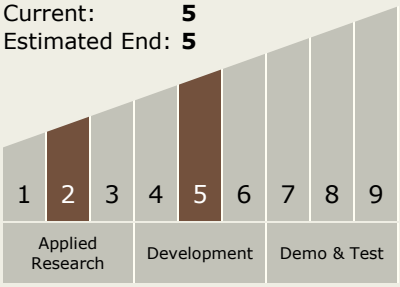
Completed Technology Project (2011 - 2014)

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.1 Sensors: Air, Water, Microbial, and Acoustic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System